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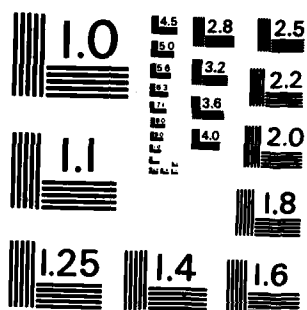
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Health Risks in Naval Occupations: An Overview

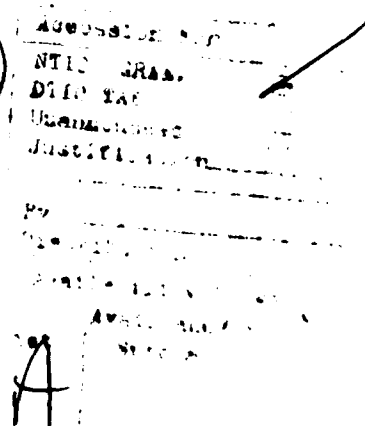
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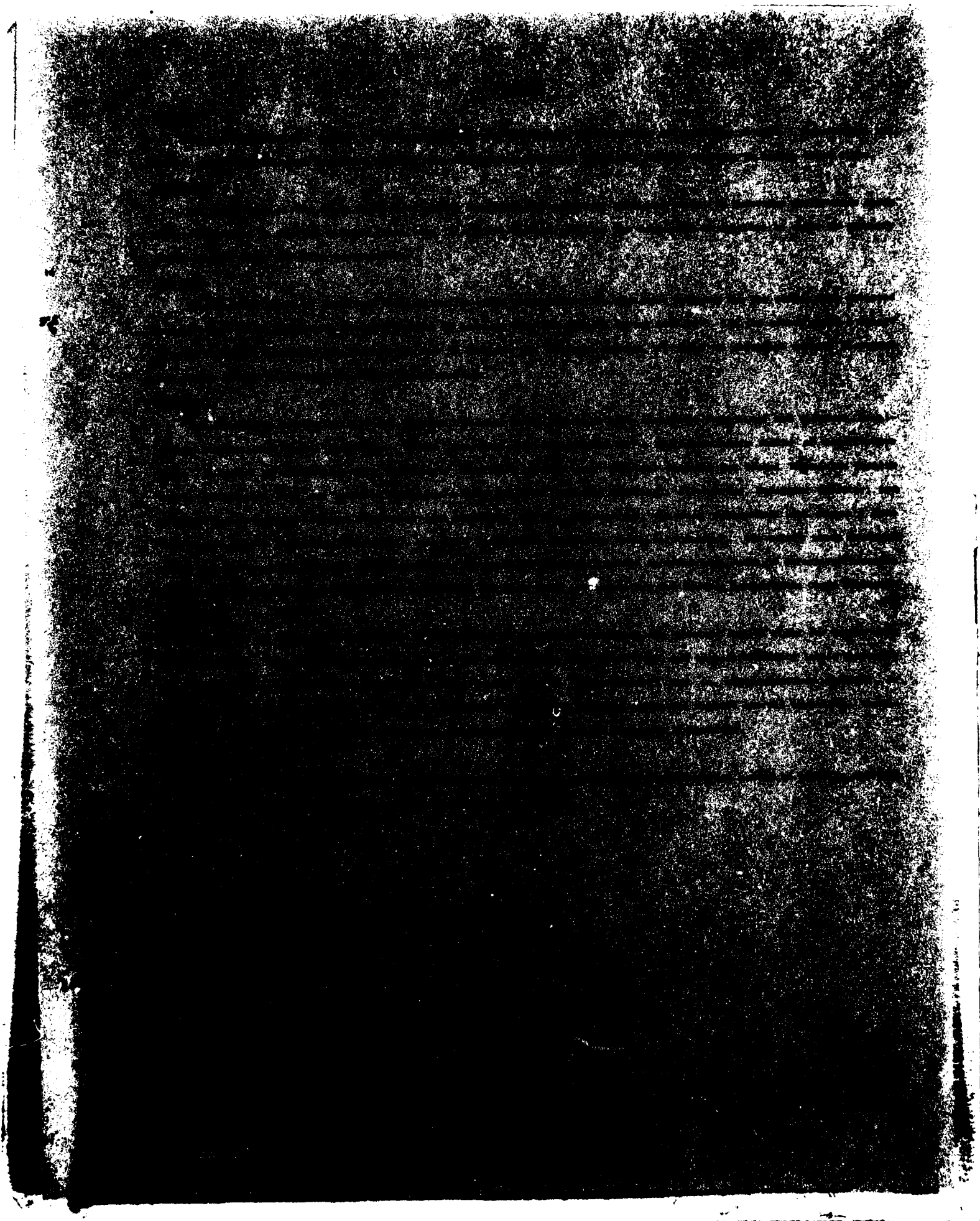
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Health Risks in Naval Occupations: An Overview

The risks of injury and illness in Navy industrial and operational environments are many and diverse. The magnitude or severity of these risks presumably depends upon the particular physical, chemical, and biological hazards associated with each occupation and work environment and the protective and preventive measures in place to reduce such risks.

The provisions of the Occupational Safety and Health Act (OSHA) of 1970 were extended to federal employees by Executive Order 11807 and implemented within the Navy by a series of instructions and documents mandating work place reporting and monitoring requirements. The scope of the Navy's occupational health problem is reflected in the fact that work environments and operating conditions encompass ships and shore facilities, the continental U.S. and bases overseas, men and women, military personnel and civilians, extremes of heat and cold, toxic chemicals and explosives, and exposures to both acute and chronic stressors in many forms and combinations. Maintaining the health and well-being of naval personnel in the face of this wide array of potential hazards is a considerable challenge to the Navy Medical Department. The operational readiness of Navy combat units depends to some extent upon success in fulfilling this mission.

The purpose of this study is to conduct the first in a series of investigations of the principal risks to the health of naval personnel and of the measures that might be instituted to reduce such risks. At present more than 1,500,000 workdays are lost each year to injury and disease among active duty personnel. This equals about 3,600 man-years--more than enough to man 10 destroyers for an entire year. This paper will describe the overall magnitude and specific nature of the Navy's health problems. The first phase of the study examines Navy hospital admission rates by disease and injury categories over more than a decade to determine the kinds of health risks that are most common in naval service and to establish Navy-wide base rates as a framework for making comparisons among individual occupations. In the second phase of the study differences in disease and injury rates among specific occupations will provide the basis for identifying unusual risks and associated manpower losses.

Archival medical data gathered by the Naval Medical Department have made possible epidemiologic studies to describe disease and injury rates Navy-wide. Available inpatient medical data tend to be uniform, complete, and accurate, and over the past several years the Naval Health Research Center in San Diego has developed and maintained a computer file of hospitalization, medical board (disability), and death records for all active duty Navy personnel. Such records are updated annually, and a unique feature of this file is that the various record systems are compiled into individual medical histories which reflect morbidity and mortality over entire naval careers.

METHOD

Hospitalization rates were computed for the entire Navy enlisted population and for 56 separate Navy occupations over the period July 1965 through December 1976. Hospitalization records originally were collected by the Naval Medical Data Services Center, Bethesda, Maryland, and then were edited and compiled into individual medical histories for research purposes at the Naval Health Research Center, San Diego. The patient population in the first phase of the study included all active duty Navy enlisted personnel hospitalized in naval medical facilities during the 1965-1976 period. In the final phase of the study a cohort of all male enlisted personnel who entered service in 1960-1961 and reenlisted were followed through most of their naval careers to determine medical histories for selected high-risk occupations.

Variables selected for study from the hospitalization records included primary diagnosis, number of days hospitalized, and occupational specialty at the time of hospitalization. Diagnoses were in accordance with the International Classification of Disease Adapted for Use in the United States, Eighth Revision.

Disease rates were first computed by major diagnostic categories for the entire Navy enlisted population in order

to establish the most common health risks in naval service and to provide a standard against which to compare rates for specific occupations. Population data for the total Navy and for the 56 individual occupations were compiled from annual reports of Navy Military Personnel Statistics (NAVPERS 15658). Average personnel strengths were computed for each occupation separately and for the total Navy over the 11½ years of the study. Occupations were compared in terms of admission rates (numbers of hospitalizations per 1,000 population per year) and percent of expected hospital admissions and non-effective days. Percent of expected was obtained by calculating the ratio of the actual number of cases to the expected number and multiplying by 100. The expected number of cases for a given occupation was determined by multiplying the admission rate for the total Navy times the personnel strength for that occupation.

RESULTS

Health risks to naval personnel are reflected directly in hospital admission rates and noneffective days. Results are presented in terms of: (1) admission rates by major disease category and subcategory for the entire Navy enlisted population, (2) overall admission rates for each of 56 naval occupations, and (3) disease profiles for selected high-risk occupations using a longitudinal cohort approach.

Health Risks by Disease and Occupation

Navy-wide Risks of Disease and Injury. Admission rates for major disease categories and subcategories are shown in Table 1. The diagnostic category with the highest incidence rate is Accidents, Poisonings, and Violence. The most frequent type of injury under this category was fracture of a lower limb, i.e., femur, patella, tibia, fibula, ankle, tarsal, metatarsal, or phalanges. Fractures of the upper limb also were relatively frequent.

The second most common type of accidental injury was sprain or strain of the sacroiliac region or back. Sprains or strains of the knee or ankle also were relatively frequent, followed by dislocation of the knee. Finally, open wounds of the upper limb were a relatively common type of injury.

Respiratory disease was the next major category in Navy-wide incidence. Acute upper respiratory infections, followed by pneumonias of all types and pharyngitis, bronchitis, and tonsillitis, were the most common subcategories of respiratory disease. There were far fewer noneffective days associated with respiratory diseases than with accidents or mental disorders, however.

Mental disorders were next in overall incidence. Personality disorders led the listed subcategories in both admission rate and noneffective days. Alcoholism, which usually is included under personality disorder but here is considered separately, is a prominent subcategory as is neurosis. Transient situational disturbance, schizophrenia, and drug dependence were the remaining most frequent subcategories. Schizophrenia resulted in the longest periods of hospitalization of any disease subcategory, and, as previously noted, mental disorders generally were responsible for a disproportionate number of noneffective days.

Digestive disorders were next in overall incidence. Inguinal hernia was the leading subcategory, followed by acute appendicitis and gastroenteritis/colitis. Ulcers were of somewhat lesser incidence but accounted for a relatively large number of noneffective days.

Skin diseases ranked next in frequency with cellulitis being the most common subcategory.

Diseases of the Musculoskeletal System and Connective Tissue were next in importance. Internal derangement of the joint and other diseases of the joint were the most frequent subcategories. Synovitis/bursitis/tenosynovitis and displacement of intervertebral disc also were prominent subcategories. The latter condition accounted for an inordinate number of noneffective days.

Diseases of the Genitourinary System were relatively low in incidence in this young, predominantly male population. Redundant prepuce/phimosis was the most common subcategory, but this condition accounted for relatively few noneffective days. Calculus of the kidney/ureter also was a significant subcategory.

Table 1

Hospital Admission Rates, Noneffective Days, and Average Length of Hospitalization
for Active Duty Naval Personnel by Major Disease Category and Subcategory

Disease Category and Subcategory ^a	Number of Admissions	Admission Rate ^b	Number of Noneffective Days	Average Length of Hospitalization ^c
Accidents, Poisonings, and Violence	140,653	2,163	4,374,866	31.10
Fracture, lower limb ^d	16,616	255	1,097,261	6.59
Sprain/Strain, sacroiliac/back	11,324	174	170,654	15.07
Fracture, upper limb	9,793	151	395,118	40.35
Fracture, face bones	7,768	119	249,476	32.12
Sprain/Strain, knee/ankle	7,099	109	133,722	18.84
Dislocation, knee	5,981	92	261,984	43.80
Open wound, upper limb	5,877	90	210,748	35.86
Diseases of the Respiratory System	135,689	2,087	1,380,320	10.17
Acute upper respiratory infection	33,579	516	193,567	5.76
Pneumonia, all types	29,394	452	412,562	14.04
Acute pharyngitis	12,181	187	65,194	5.35
Bronchitis	10,334	159	107,831	10.43
Acute tonsillitis	9,866	152	56,526	5.73
Hypertrophy tonsils/adenoids	8,461	130	84,020	9.93
Deflected nasal septum	5,508	85	69,401	12.60
Mental Disorders	83,637	1,286	2,382,511	28.49
Personality disorder	26,392	406	731,521	27.72
Alcoholism	13,038	200	341,494	26.19
Neurosis	12,211	188	353,285	28.93
Transient situational disturbance	8,566	132	135,879	15.86
Schizophrenia	7,423	114	512,966	69.10
Drug dependence/improper use	5,999	92	52,138	8.69
Diseases of the Digestive System	75,356	1,159	1,540,331	20.44
Inguinal hernia	19,892	306	402,056	20.21
Acute appendicitis	9,494	146	175,581	18.49
Gastroenteritis/colitis	8,169	126	54,728	6.70
Ulcer, stomach/duodenum	7,230	111	240,209	33.22
Infective and Parasitic Diseases	59,130	909	1,111,358	18.80
Rubella	10,466	161	51,861	4.96
Infectious mononucleosis	9,839	151	197,155	20.04
Other viral	7,037	108	57,937	8.23
Viral hepatitis	6,448	99	259,579	40.26
Diarrheal diseases	5,581	86	37,501	6.72
Diseases of the Skin and Subcutaneous Tissue	58,938	906	744,008	12.62
Cellulitis	34,962	538	288,815	8.26
Pilonidal cyst	6,559	101	151,061	23.03
Musculoskeletal and Connective Tissue Diseases	54,863	844	1,929,611	35.17
Internal derangement of joint	10,237	157	413,925	40.43
Other diseases of joint	9,288	143	321,029	34.56
Synovitis/bursitis/tenosynovitis	6,381	98	109,253	17.12
Displacement intervertebral disc	5,602	86	294,522	52.57

^aInternational Classification of Diseases, Adapted for Use in the United States (ICDA-8)

^bNumber of hospital admissions per 100,000 population per year during the period July 1965-December 1976.

^cIn days.

^dSubcategories were grouped as appropriate; e.g., "lower limb" included femur, patella, tibia, fibula, ankle, tarsal, metatarsal, and phalanges. Only subcategories with more than 5,000 admissions are shown.

<u>Disease Category and Subcategory</u>	<u>Number of Admissions</u>	<u>Admission Rate</u>	<u>Number of Noneffective Days</u>	<u>Average Length of Hospitalization</u>
Diseases of the Genitourinary System	43,592	670	528,135	12.12
Redundant prepuce/phimosis	14,263	219	77,896	5.46
Calculus of kidney/ureter	5,309	82	75,914	14.30
Diseases of the Circulatory System	27,197	418	788,409	28.99
Hemorrhoids	5,825	90	89,414	15.35
Essential benign hypertension	5,247	81	131,056	24.98
Diseases of the Nervous System and Sense Organs	23,976	369	702,697	29.31
Neoplasms	17,126	263	577,163	33.70
Benign, all types	12,256	188	299,143	24.41
Endocrine, Nutritional, and Metabolic Diseases	8,742	134	344,967	38.32
Diseases of the Blood and Blood-forming Organs	2,450	38	66,763	27.25

Circulatory diseases were relatively infrequent in this population which was largely in the age range from 18 to 34 years. Hemorrhoids and hypertension were the most common subcategories.

Diseases of the Nervous System and Sense Organs, Neoplasms, Endocrine/Nutritional/Metabolic Diseases, and Diseases of the Blood and Blood-forming Organs were relatively rare in this population.

Occupational Differences in Risk of Disease or Injury. Hospital admission rates for 56 enlisted occupations are shown in Table 2. Occupations are ranked from highest to lowest on admission rate. In addition, percent of expected has been calculated for both the number of admissions and the number of noneffective days. Percent of expected, the ratio of the disease rate in a particular occupation to that in the Navy as a whole, is a convenient way to express risk. Table 2 then presents the risk of disease/injury experienced by each occupational group over the entire observation period of more than a decade. It can be seen that admission rates and noneffective days varied greatly among these occupations.

These 56 occupations can be divided into quartiles for purposes of description and comparison. Those in the top quartile (based on ranking by admission rate) are tentatively labeled "high-risk" Navy occupations. The occupations in this category can be grouped and characterized as follows:

Hospital Corpsman and Dental Technician (health care). Hospital corpsmen assist medical professionals in providing health care to service personnel and their families. Much of this work is performed in hospitals, clinics, or laboratories in the continental U.S., but corpsmen also serve aboard ships and in the field with the Marine Corps. Dental technicians assist dental officers in treating patients or performing laboratory functions. Most of their time is spent in Dental Clinics in the continental U.S. or overseas.

Hospital corpsmen incurred the greatest risks of disease or injury of any naval occupation with an overall admission rate more than double that of the Navy norm and a grossly disproportionate number of noneffective days. Dental technicians had a relatively high admission rate but were slightly below the norm for noneffective days, suggesting that this group was hospitalized for less severe conditions than other high-risk occupations, particularly hospital corpsmen.

Boatswain's Mate and Aviation Boatswain's Mate (boat or aircraft handling). Boatswain's Mates maintain equipment and machinery on ships' decks; handle cargo, and operate small boats. Aviation Boatswain's Mates fuel, move, and launch aircraft; handle cargo, and maintain and repair launch and recovery equipment.

The Boatswain's Mate specialty was second highest in health risks among Navy occupations. Both hospital admission rate and noneffective days were far above the Navy-wide norms. Aviation Boatswain's Mate also was well above expected levels on these morbidity indices.

Steelworker, Equipment Operator, and Builder (construction). Steelworkers work with steel and sheet metal in fabricating buildings, bridges, and other structures. Equipment operators work on construction projects operating bulldozers, power shovels, pile drivers, rollers, graders, and so on. Builders construct and repair all types of wood and concrete structures, serving as carpenters, roofers, plasterers, cement finishers, masons, etc.

The Steelworker specialty was one of the highest in overall risk of illness/injury. Equipment operators tended to have more severe injuries than most other high-risk occupations as reflected in longer hospital stays. Builders were above the Navy norms on both admissions and noneffective days.

Boiler Technician and Engineman (marine engineering). Boiler Technicians repair and maintain steam boilers and auxiliary machinery. Enginemen service and repair internal combustion engines and auxiliary machinery. Both groups work in hot, dirty, and noisy environments and spend most of their time aboard ship.

Boiler Technicians incur relatively high risks of disease or injury and a high rate of noneffective days. Enginemen experience somewhat lower and less severe risks, but this group falls in the top quartile on both morbidity indices.

Aviation Ordnanceman and Gunner's Mate (ordnance). Aviation Ordnancemen store, maintain, inspect, and handle all types of weapons and ammunition carried on Navy aircraft. Gunner's Mates are responsible for all kinds of weapons and ammunition aboard ship.

Aviation Ordnancemen have a relatively high admission rate and a noneffective rate slightly above the norm. Gunner's Mates are particularly high on noneffectiveness rate.

Ship's Serviceman (services). Ship's Servicemen provided a variety of services to Navy personnel, including barber-shop, ship's store, laundry, and dry-cleaning.

Ship's Servicemen have a relatively high admission rate and an exceptionally high rate of noneffectiveness.

Table 2
Hospital Admission Rates and Noneffective Days for 56 Navy Occupations

Occupation ^a	Average Number on Active Duty ^b	Hospital Admissions			Noneffective Days	
		Number per Year	Admission Rate ^c	Percent of Expected ^d	Number per Year	Percent of Expected ^d
Hospital Corpsman	26,425	5,638	213	222	123,826	188
Boatswain's Mate	11,401	1,551	136	142	46,933	165
Dental Technician	3,674	427	116	121	8,595	94
Steelworker	1,113	130	117	121	3,317	119
Aviation Boatswain's Mate	5,298	606	114	119	14,167	107
Boiler Technician	11,787	1,338	113	118	38,137	130
Equipment Operator	3,771	419	111	116	14,497	154
Aviation Ordnanceman	5,568	616	111	115	14,112	102
Ship's Serviceman	4,664	517	111	115	15,187	130
Hull Maintenance Technician	12,048	1,273	106	110	35,058	117
Electronics Warfare Specialist	1,288	134	104	108	2,675	83
Builder	3,290	339	103	107	9,688	118
Gunner's Mate	8,571	862	100	105	26,553	124
Engineman	10,772	1,077	100	104	32,284	120
Utilitiesman	1,595	159	100	104	4,250	107
Signalman	3,909	384	98	102	11,201	115

^aOccupations were rank ordered by admission percent of expected.

^bAverage number of enlisted personnel on active duty in designated occupations at the end of each year (Navy Military Personnel Statistics) for the period July 1965-December 1976. Only individuals in designated occupations are included.

^cNumber of admissions per 1,000 population per year.

^dBased upon the ratio of admission rate or noneffective days for the particular occupation to admission rate/noneffective days for the entire enlisted population.

Occupation	Hospital Admissions				Noneffective Days	
	Average Number on Active Duty	Number per Year	Admission Rate	Percent of Expected	Number per Year	Percent of Expected
Construction Electrician	1,847	182	98	102	4,713	102
Construction Mechanic	2,216	218	98	102	5,771	104
Aircrow Survival Equipmentman	2,072	198	96	99	4,752	92
Machinist's Mate	22,587	2,120	94	98	59,115	105
Aviation Machinist's Mate	16,943	1,561	92	96	37,029	88
Aviation Storekeeper	3,709	341	92	96	7,617	82
Aviation Maintenance Administration- man	2,662	242	91	95	4,778	72
Photographer's Mate	2,550	234	92	95	5,266	83
Postal Clerk	1,211	111	92	95	2,750	91
Aviation Structural Mechanic	15,292	1,374	90	93	32,237	84
Electrician's Mate	13,819	1,233	89	93	35,297	102
Machinery Repairman	2,960	264	89	93	6,851	93
Quartermaster	5,205	459	88	92	13,320	102
Aviation Supply Equipment Technician	1,883	164	87	91	3,839	82
Mess Management Specialist	23,227	2,036	88	91	59,807	103
Torpedoman's Mate	4,752	417	87	91	11,805	99
Storekeeper	10,947	943	86	90	27,076	99
Interior Communications Electrician	5,922	502	85	88	13,404	91
Aviation ASW Operator	2,509	209	83	87	4,470	71
Personnelman	7,126	579	81	85	14,197	80
Operations Specialist	8,910	720	80	84	20,784	93
Aviation Electrician's Mate	8,603	688	80	83	15,463	72
Ocean Systems Technician	1,071	84	78	82	1,986	74
Radioman	19,776	1,555	79	82	40,668	82
Yeoman	14,612	1,138	78	81	28,831	79
Disbursing Clerk	2,413	187	77	81	4,896	81
Aerographer's Mate	1,908	147	77	80	3,192	67
Aviation Electronics Technician	11,512	873	76	79	19,449	68
Air Controlman	2,772	211	76	79	4,452	64
Aviation Fire Control Technician	3,768	268	71	74	5,945	63
Sonar Technician	6,506	458	70	73	12,887	79
Fire Control Technician	9,576	633	66	69	18,250	76
Electronics Technician	18,983	1,242	65	68	33,619	71
Aviation ASW Technician	2,047	132	64	67	2,927	57
Tradesman	1,646	105	64	66	2,436	59
Data Processing Technician	3,221	199	62	64	4,802	60
Missile Technician	1,350	82	61	63	2,239	66
Musician	1,382	82	59	62	2,309	67
Data Systems Technician	1,529	88	57	60	2,301	60
Cryptologic Technician	11,739	531	45	47	12,661	43

Hull Maintenance Technician (ship maintenance). Hull Maintenance Technicians perform metalwork and carpentry aboard ship and maintain plumbing and ventilating systems.

This group is above Navy norms for both admissions and noneffective days.

Electronics Warfare Technician. Men and women in this specialty operate and maintain electronic equipment used for navigation, target detection, and location. While the admission rate for this occupation falls in the top quartile, the noneffectiveness rate falls well below that of the other high-risk occupations, perhaps calling into question whether this group should be so classified.

Most of the occupations falling in the second quartile were blue-collar trades: Utilitiesman (plumber), Construction

Electrician, Construction Mechanic, Machinist's Mate, Aviation Machinist's Mate, Aviation Structural Mechanic, Electrician's Mate, and Machinery Repairman. A few were administrative or clerical: Aviation Storekeeper, Aviation Maintenance Administrationman, and Postal Clerk. Signalman and Photographer's Mate also appear in the second quartile. Signalmen send and receive messages from the bridge of a ship and maintain signal equipment. Photographer's Mates take photographs and motion pictures, operate laboratory and darkroom equipment, and mix photographic chemicals and solutions.

Occupations falling in the third quartile were mostly clerical or administrative: Quartermaster, Aviation Supply Equipment Technician, Mess Management Specialist, Storekeeper, Personnelman, Yeoman, and Disbursing Clerk. Others were primarily of a technical nature: Interior Communications Electrician, Aviation Anti-Submarine Warfare Operator, Operations Specialist, Aviation Electrician's Mate, Ocean Systems Technician, and Radioman. One occupation, Torpedoman's Mate, was concerned with maintaining, repairing, and testing underwater or submarine ordnance.

All of the occupations in the lowest quartile, which involves least risk, were highly technical or highly skilled jobs: Aerographer's Mate (meteorology), Aviation Electronics Technician and Electronics Technician, Aviation Fire Control Technician and Fire Control Technician, Air Controlman, Sonar Technician, and Aviation Anti-Submarine Warfare Technician. The Tradesman (Training Devices) specialty involves operations and maintenance of electronic equipment used for training devices, particularly in aviation. Data Processing Technicians and Data Systems Technicians operate and maintain data processing equipment. Missile Technicians maintain Polaris and Poseidon missiles and test missile electronic components. Navy Musicians are highly qualified professionals who perform at concerts, ceremonies, parades, and many other social functions. The Cryptologic Technician--the safest and healthiest Navy occupation in terms of both admissions and noneffective days--operates and maintains communications equipment involved in worldwide security operations.

Disease Profiles for Selected High-Risk Occupations

In the second phase of the study a number of occupations identified as "high-risk" were studied in more detail to examine the specific types of disease risks that are associated with each occupation. All male personnel who enlisted in the Navy during 1960-1961 were followed to determine (1) those who reenlisted and (2) medical histories of this cohort after reenlistment, that is, from July 1965 through December 1976. Adjustments were made for losses from the cohort, and admission rates and percents of expected were calculated based upon man-years of exposure. Percent of expected admissions for each occupation and each major disease category are shown for the five largest "high-risk" occupational groups--Hospital Corpsman, Boatswain's Mate, Boiler Technician, Hull Maintenance Technician, and Engineman--Figures 1-5. Smaller occupational groups were not included because of the relatively small numbers of cases available in many disease categories. Disease profiles for two of the lowest risk occupations--Electronics Technician and Cryptologic Technician--are plotted in Figures 6 and 7 for purposes of comparison and contrast.

Hospital Corpsman. The cohort data confirm the earlier cross-sectional results which indicate that Hospital Corpsmen incurred the highest morbidity rates of any Navy occupation. This specialty had extremely high rates of Infective and Parasitic Disease and Mental Disorders--more than double the rate for the whole Navy. This group also had high rates on Symptoms and Ill-Defined Conditions, Skin Diseases, Accidents, and Diseases of the Musculoskeletal System. Diseases of the Digestive System also were well above normal incidence.

Boatswain's Mate. This occupational group manifested very high rates of Mental Disorders and Accidents. Symptoms and Ill-Defined Conditions and Skin Diseases also were elevated.

Boiler Technician. This specialty showed very high rates of Diseases of the Circulatory System, Nervous System and Sense Organs, Mental Disorders, Symptoms and Ill-Defined Conditions, Skin Diseases, Accidents, and Diseases of the Musculoskeletal System. Diseases of the Digestive System also were well above normal incidence.

Hull Maintenance Technician. Again the disease profile for this specialty was quite different from that for other high-risk occupations. The highest disease incidence was for Neoplasms. Other high incidence disease categories included

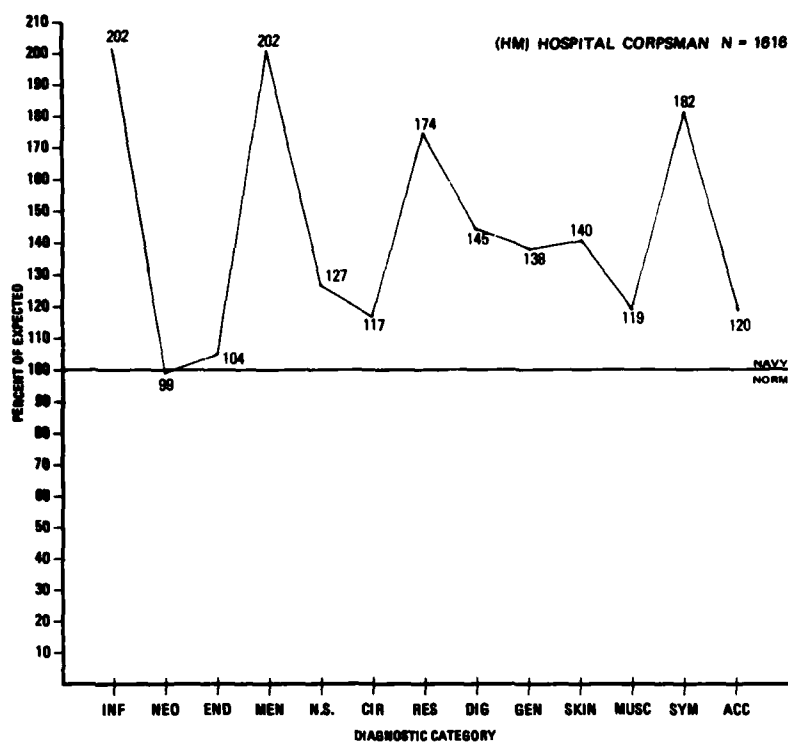


Fig. 1. Disease Profile for Hospital Corpsmen in Terms of Percent of Expected Admission Rate. (Legend: Inf - Infective and Parasitic Diseases; Neo - Neoplasms; End - Endocrine, Nutritional, and Metabolic Diseases; Men - Mental Disorders; N.S. - Diseases of the Nervous System and Sense Organs; Cir - Circulatory Diseases; Res - Respiratory Diseases; Dig - Digestive System Diseases; Gen - Genitourinary Diseases; Skin - Skin Diseases; Musc - Musculoskeletal and Connective Tissue Diseases; Sym - Symptoms and Ill-Defined Conditions, and Acc - Accidents, Poisonings, and Violence.)

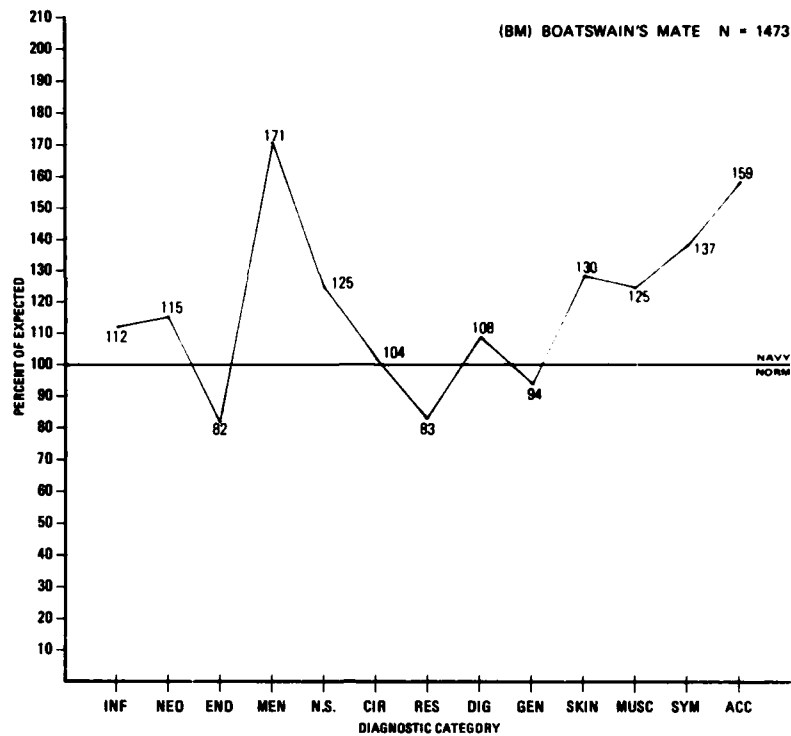


Fig. 2. Disease Profile for Boatswain's Mates

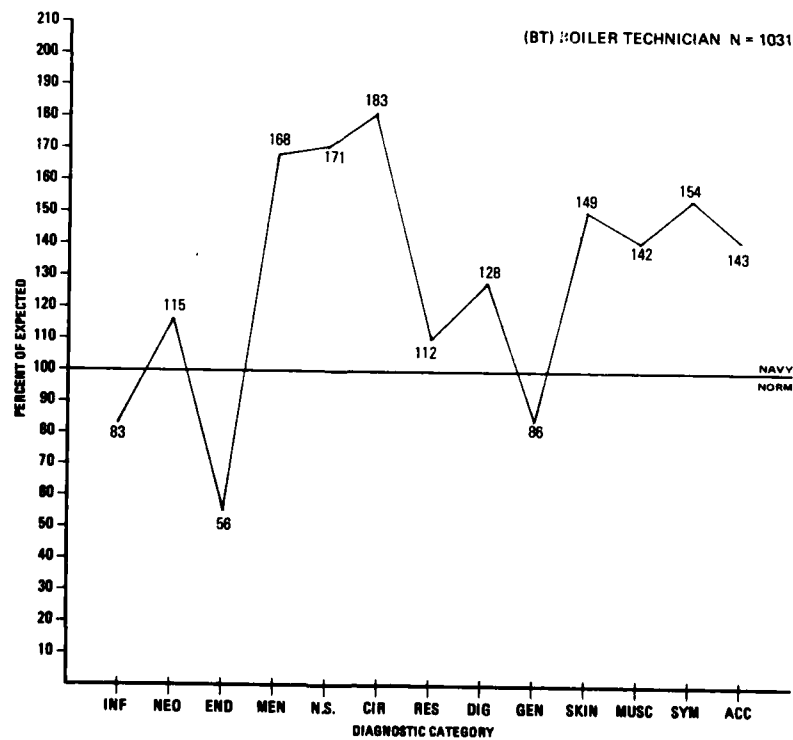


Fig. 3 Disease profile for Boiler Technicians

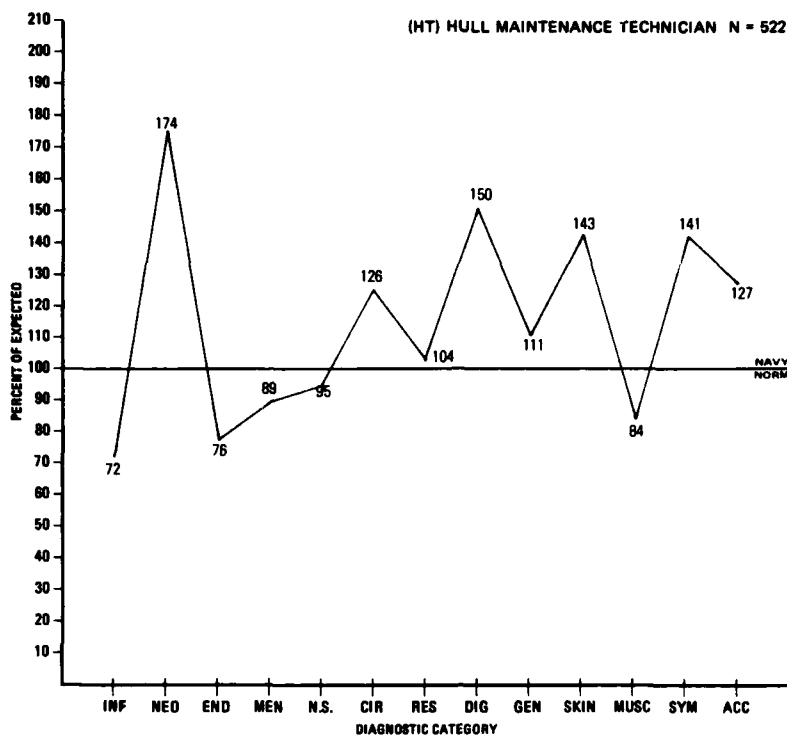


Fig. 4. Disease Profile for Hull Maintenance Technicians

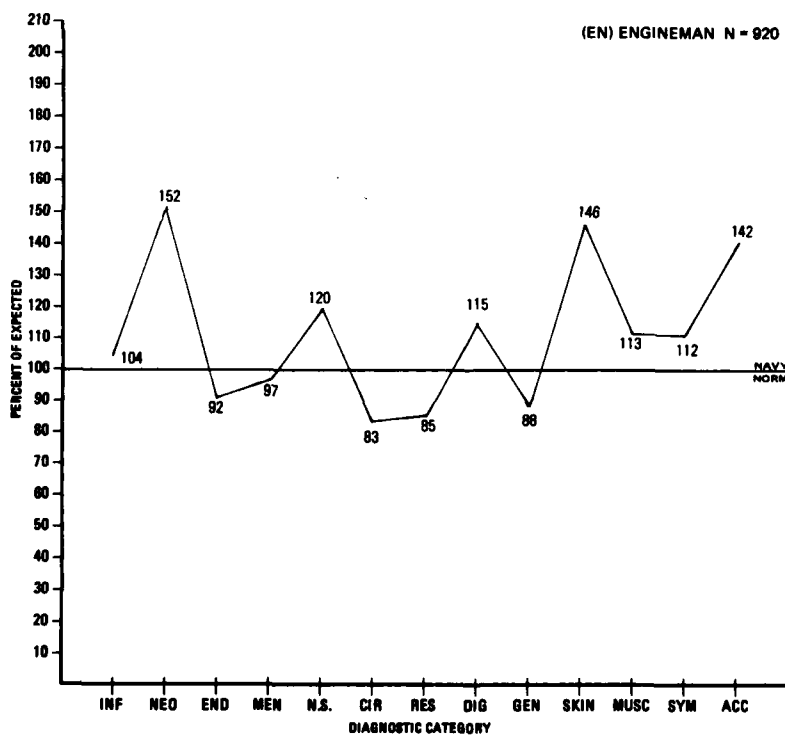


Fig. 5. Disease Profile for Engineman

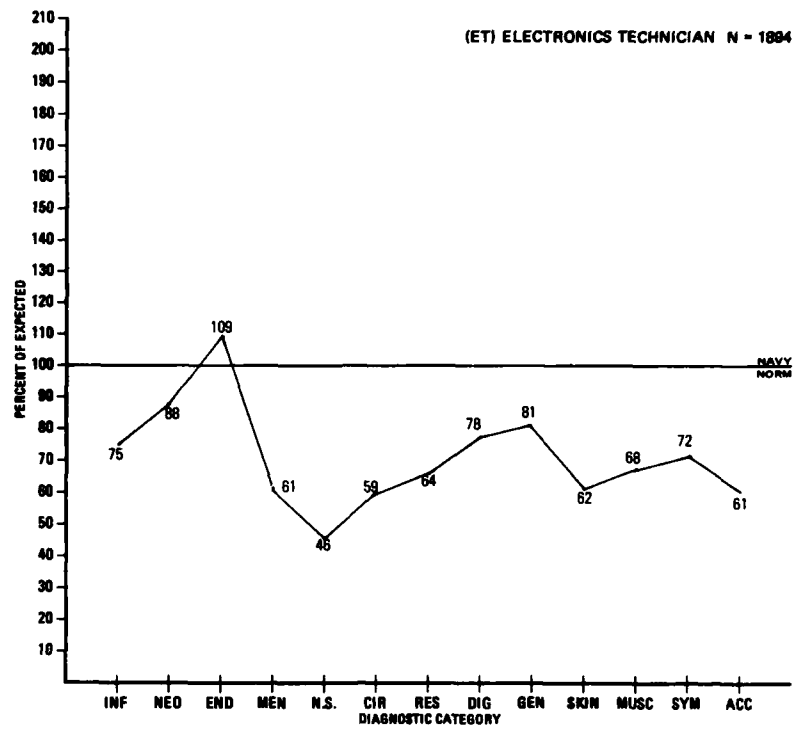


Fig. 6. Disease Profile for Electronics Technician

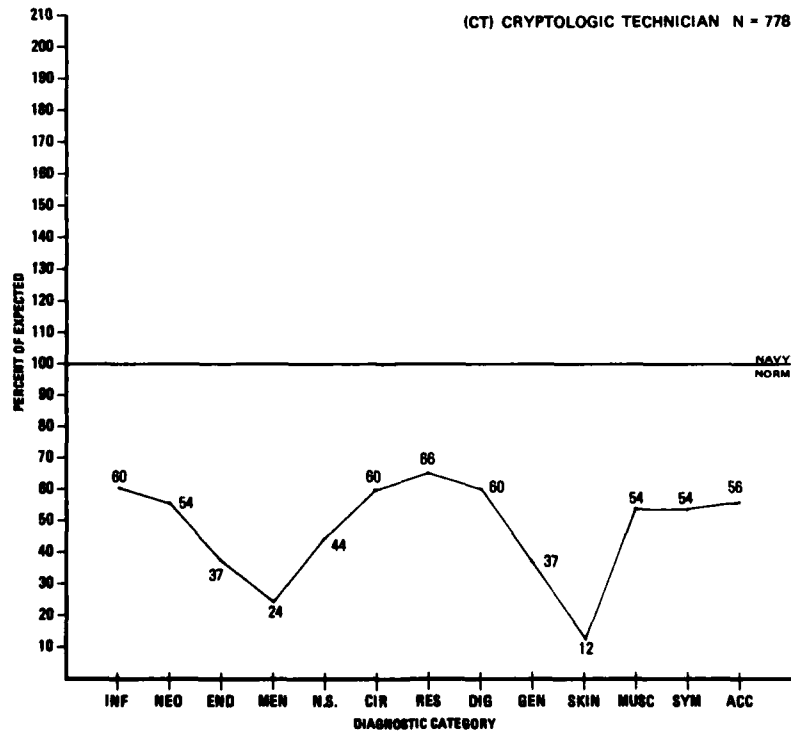


Fig. 7. Disease Profile for Cryptologic Technician

Digestive, Skin, Symptoms and Ill-Defined Conditions, Circulatory, and Accidents.

Engineman. This specialty showed less extreme deviations in disease incidence than other high-risk occupations but, nevertheless, had admission rates well above normal for Neoplasms, Skin Diseases, and Accidents. Diseases of the Nervous System and Sense Organs also were somewhat more frequent than the Navy norm.

Electronics Technician. This "low-risk" occupation was well below the Navy norm for all disease categories except Endocrine, Nutritional, and Metabolic Diseases, and the incidence for this disease category was only slightly above the norm.

Cryptologic Technician. It is apparent from Figure 7 that this occupation must be considered the safest and healthiest in the Navy. Disease incidence was far below the norm in all categories.

DISCUSSION

Both the cross-sectional and longitudinal results indicated that Navy occupations vary widely in hospital admission and noneffectiveness rates. Because these occupations differ somewhat in personnel composition, it is necessary to consider the possible effects of demographic differences on morbidity.

Both men and women were included in the cross-sectional analyses. It has been shown elsewhere that the hospitalization rate for Navy women is more than double that for Navy men (1). However, women constitute such a small proportion of the personnel in most Navy occupations that the effect on total hospitalization rates is negligible. For example, only the Hospital Corpsman specialty had more than 5% women members. Women were excluded from the cohort analysis.

Five ethnic or racial groups can be identified in the naval population: Caucasian, Black, Malayan (Filipino), American Indian, and Asian American. Differences in overall hospitalization rates have been reported for these five groups (2). The composition of the Navy during the period of this study was approximately as follows: Caucasian, 88%; Black, 7%; Filipino, 5%, and American Indian and Asian American together less than 1%. The only occupations in which there were sufficient concentrations of minority group members to affect overall hospitalization rates were Mess Management Specialist (cooks and stewards) and Ship's Serviceman (barbers, laundrymen, etc.). More than one-half of the Filipino personnel in the Navy were cooks and stewards. Filipino sailors enlist under a contract between the Philippine and U.S. Governments and almost always make the Navy a career; they tend to be older and have much lower hospital admission rates than other racial/ethnic groups. Thus, estimates of morbidity for the Mess Management Specialist group, and to a lesser extent the Ship's Serviceman group, are confounded by racial composition factors. Except for the Mess Management Specialist group, differences in age among the occupational groups studied were small and could not have had significant effects upon morbidity.

It was clear from Table 2 that occupations in the upper quartiles of risk were generally "blue-collar" while occupations in the lower quartiles tended to be "white-collar," that is, administrative, clerical, or technical. Aptitude (mental ability) requirements for occupations in the upper quartiles (high risk) generally were lower than those for occupations in the lower quartiles. Therefore, there is a possible confounding of occupation with aptitude or mental ability which was not evaluated within the framework of the present study. Future research should examine the relationship of mental ability to hospital admission rate within occupation to isolate and clarify these effects. A previous study has shown that overall accidental injury rates in the Navy vary with mental ability, but the same effect has not been demonstrated within occupation (3); another study of occupational differences in morbidity among naval personnel did not consider the effect of mental ability or demographic variables (4).

The present findings provide preliminary indications for occupational health program planning. It is clear that accidental injury and mental disorders constitute the greatest health risks for active duty naval personnel in terms of manpower losses and costs to the Navy. Respiratory and other infectious diseases also constitute a substantial burden. Thus, Orthopedic Surgery, Psychiatry, and Internal Medicine are medical specialties of salient importance in terms of numbers of active duty personnel requiring inpatient care. It has been noted that there is a severe shortage of Orthopedic Surgeons in the

Navy while specialists in Internal Medicine are relatively plentiful (5). Under these circumstances it appears that any significant reduction of serious injuries would not only reduce medical and manpower costs directly but also would help relieve a critical situation of staff shortages and deficiencies in available orthopedic care.

The findings with respect to occupational differences clearly identified Navy occupations that were at highest risk for illness or injury and established priorities for future research. Secondly, the profiles of disease obtained for selected high-risk occupations pointed to probable etiological or risk factors in the work environment. For example, high rates of Infective and Parasitic Diseases among Hospital Corpsmen probably reflect exposure to contagious diseases on hospital wards and in carrying out patient care activities such as drawing blood or administering medications. The high rate of Diseases of the Circulatory System and Nervous System/Sense Organs among Boiler Technicians could well reflect exposure to high intensity noise in ship engine rooms. The present findings offer fertile ground for generating many useful hypotheses concerning adverse health effects in naval environments. Epidemiologic analyses of work environments and job activities in relation to specific health consequences are essential for the systematic identification and control of occupational health hazards and meeting the Navy's objectives in occupational health and safety.

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major disease categories were accidental injuries, respiratory diseases, and mental disorders. Occupations at highest risk for disease or injury were the Hospital Corpsman (health care), Boatswain's Mate (boat handling and maintenance), and Steelworker (construction) specialties. A cohort study of 1960-1961 enlistees provided unique disease risk profiles for selected high-risk occupations. For example, Corpsmen incurred high rates of Infective/Parasitic Disease and Mental Disorders while Boiler Technicians had high rates of Circulatory and Nervous System/Sense Organ Disease. The findings will guide more detailed analyses of environmental hazards and job activities in relation to health consequences as a basis for systematic identification and control of job-related health hazards in naval environments.

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